tuning within the reach of ordinary musicians; for this purpose the theory and practice are reduced to their simplest forms.

A notation is described, adapted to use with ordinary written music, by which the notes to be performed are clearly distinguished.

The design of a key-board is described, by which any system of tuning, except the ordinary equal temperament, can be controlled, if only the fifths of the system be all equal. The design is on a symmetrical principle, so that all passages and combinations of notes are performed with the same handling, in whatever key they occur.

The theory of the construction of scales is then developed, and a diagram is given, from which the characteristics of any required system can be ascertained by inspection.

An account is then given of the application of such systems to the new key-board, and particularly of an harmonium which has been constructed and contains at present the division of the octave into fifty-three equal intervals in a complete form. Rules for tuning are given.

Finally, the application of the system of fifty-three to the violin is discussed.

Throughout the work of former labourers in the same field is reviewed: the obligations of the writer are due to Helmholtz, the late General T. Perronet Thompson, F.R.S., and others.

III. "On the Composition and Origin of the Waters of a Salt Spring in Huel Seton Mine, with a Chemical and Microscopical examination of certain Rocks in its vicinity." By J. Arthur Phillips, Mem.Inst.C.E. Communicated by Professor Ramsay, F.R.S. Received December 12, 1872.

(Abstract.)

Huel Seton Copper-Mine is situated about one mile north-east of the town of Camborne, Cornwall, and is distant from the sea, on the north coast, a little more than three miles.

The workings of Huel Seton are entirely in "killas," or clay-slate, and the saline waters issue at the rate of 50 gallons per minute, and at a temperature of 92° F., from the eastern fore breast of the 160-fathom level. This has intersected a fault, or cross course, which may be traced in a northerly direction to the sea. The temperature of the level from the end of which the water issues, like that of the water itself, is 92° F. The following results, in grammes per litre and grains per gallon, were obtained by analysis. Sp. gr. 1·0123. Total solid contents 14·3658 grammes per litre, or 1005·61 grains per gallon.

	Grammes per litre.		Grains per gallon.	
	I.	II.	I.	II.
Carbonic acid	·0795	·0786	5·56	5·50
Sulphuric acid	·0178	·0177	1·25	1·24
Silica	·0270	·0280	1·89	1·96
Chlorine	9·1728	9·1662	642·10	641·63
Bromine	trace.	trace.	trace.	trace.
Alumina	·3456	·3460	24·19	24·22
Ferric oxide	·0031	·0033	·22	·23
Manganese	trace.	trace.	trace.	trace.
Copper	minute trace.	minute trace.	minute trace.	minute trace.
Lime	3·4795	3·4963	243·56	244·74
Magnesia	·0721	·0710	5·05	4·97
Alkaline chlorides	6·4920	6·4626	454·44	452·38
Potassium	·0832	·0835	5·82	5·84
Cæsium*	trace.	trace.	trace.	trace.
Sodium	2·2977	2·2885	160·84	160·19
Lithium	·0805	·0794	5·63	5·56
Ammonia	trace.	trace.	trace.	trace.
Nitric acid	trace.	trace.	trace.	trace.

The foregoing results may be thus tabulated † :—

	Grammes per litre.		Grains per gallon.	
	I.	II.	I.	II.
Calcium carbonate	·0921	·1011	6·45	7·08
Ferrous carbonate	·0045	·0047	·31	·33
Manganous carbonate	trace.	trace.	trace.	trace.
Calcium sulphate	·0303	·0301	2·12	2·11
Cupric chloride	minute trace.	minute trace.	minute trace.	minute trace.
Calcium chloride	6·7697	6·7934	473·88	475·54
Magnesium chloride	·1712	·1686	11·98	11·80
Aluminium chloride	·9003	·9013	63·02	63·09
Potassium chloride	·0919	·0900	6·43	6·30
Calcium chloride	trace.	trace.	trace.	trace.
Sodium chloride	5·8442	5·8210	409·09	407·47
Lithium chloride	·4888	·4820	34·22	33·74
Potassium bromide	trace.	trace.	trace.	trace.
Potassium silicate (K_2SiO_3)	·0693	·0719	4·85	5·03
Nitric acid	trace.	trace.	trace.	trace.
Ammonia	trace.	trace.	trace.	trace.
Total found by addition of constituents	14·4623	14·4641	1012·35	1012·49
Total found directly ‡	14·3658	...	1005·61	...
Free carbonic acid	·0373	·0323	2·61	2·26

* The amount of cæsium appears to be very small. On adding chloride of platinum to a rather dilute solution of the alkaline chlorides obtained from this water, a slight yellow precipitate was deposited; this, after re-solution and the removal of the platinum by sulphuretted hydrogen, afforded by the spectroscope somewhat faint indications of the presence of cæsium.

† As the state of combination in which the various substances present in mineral waters exist cannot be accurately determined, the system of grouping adopted in the Table must to some extent be regarded as arbitrary.

‡ The difference between the amount of total solid contents found directly and that

A consideration of the various phenomena connected with the occurrence of this and other apparently similar springs which have at different times been discovered in the district, would seem to lead to the inference that they all have some more or less direct communication with the sea, and that they are either the result of infiltration of sea-water through faults, or are true and independent sources which, before being tapped below the sea-level, had found their way to the ocean through faults or channels.

The following would appear, in the present state of our knowledge, a not improbable explanation of the origin of the Huel Seton spring.

The cross course is believed to extend through both granite and clay-slate to the sea. From the close contact of its surfaces, the presence of clay, and from other causes, this fault may be supposed not to be uniformly permeable by water, which can only follow a circuitous passage. In this way it penetrates to depths where reactions take place, which, although not entirely in accordance with the results of daily experience in our laboratories, can, after the investigations of M. Daubrée, M. de Sénarmont, and others, be readily understood.

By the action of *sea-water* on *silicates of calcium*, *silicates of sodium* and *chloride of calcium* may be produced. The *sulphate of sodium* of the sea-water will be decomposed by this *chloride of calcium*, with the production of *sulphate of calcium* and *chloride of sodium*. The decomposition of clayey matter by *common salt* may produce *chloride of aluminium* and *silicates of sodium*, while the *magnesium* of the chloride of magnesium may be replaced by *calcium*; lastly, a portion of the *potassium* in the sea-water appears to have been replaced by the *lithium* of the granite.

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Transactions.

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obtained by addition of constituents, is doubtless in a great measure due to the partial decomposition of aluminium and magnesium chlorides at the temperature (180° C.) at which the drying of the residue was effected.